

National Pesticide Survey

Quality Assurance/ Quality Control

The U.S. Environmental Protection Agency (EPA) has completed its five-year National Survey of Pesticides in Drinking Water Wells (NPS). A joint project of EPA's Office of Drinking Water (ODW) and Office of Pesticide Programs (OPP), the Survey was designed to assess the extent and severity of the presence of pesticides and nitrate in drinking water wells nationwide, and the relationship of pesticide use and ground-water vulnerability to the presence of pesticides and nitrate.

In conducting the Survey, EPA sampled over 1300 wells for the presence of 127 analytes, including pesticides, pesticide degradates, and nitrate. Sampling teams throughout the country collected thousands of water samples and administered questionnaires on local agriculture, pesticide use, and well construction. Eight laboratories tested the water samples using eight different analytic procedures. EPA used a broad array of data management techniques to direct the varied activities and report results. This fact sheet describes the quality assurance (QA) and quality control (QC) procedures that were carried out during the design and implementation of the Survey. These procedures ensured that data derived from the analysis of Survey samples of drinking water wells and questionnaires were of a known and useful quality.

What is QA/QC?

Quality assurance/quality control is a system of activities for ensuring the reliability and validity of data. EPA's QA programs, upon which the NPS QA program is based, provide Agency decision-makers with data that meet specified standards. QA refers to the overall management activities conducted to ensure that a project meets the agreed-upon quality standards. QC refers to the operational-level management activities conducted to ensure these same standards. Comprehensive QA/QC activities were carried out throughout the Survey and were managed by a full-time QA officer. Prior to the implementation of the Survey, QA/QC activities included determining acceptable quality standards and developing quality assurance plans, standard operating procedures, and training programs. During the Survey, these activities included field and laboratory audits, and day-by-day monitoring of well sampling and laboratory analysis. In addition, to produce reliable and unbiased Survey results, EPA conducted continuous oversight and evaluation of laboratory results and field data.

QA/QC Throughout the Survey

QA/QC systems and procedures were implemented for each element of the Survey -- design, field sampling, laboratory analysis, and data management. These elements are discussed below.

QA/QC In Survey Design. EPA's overall Survey design was independently reviewed by experts to ensure that it would produce reliable and statistically valid data. EPA tested the Survey design, as well as field sampling and analytical methods, through a pilot study conducted in three States prior to initiation of the full Survey. The Survey design was also given a scientific peer review by a special subpanel of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel

(SAP). The ten-member SAP subpanel reviewed the overall Survey design and the findings of the pilot study. The subpanel commented on four broad areas of the design: data collection, well selection for community water systems, effects of temporal variation on sampling, and analyte stability. In each of these areas, the subpanel made recommendations for improving or refining the Survey design. EPA reviewed and evaluated the subpanel's recommendations and made appropriate changes.

QA/QC In the Field. EPA developed and implemented extensive QA/QC procedures for field activities to ensure that water sampling and data collection were conducted according to specific Standard Operating Procedures (SOPs). All State and contractor personnel involved in the NPS were fully trained before undertaking field activities such as sampling and interviewing. Samplers administered specially designed questionnaires to obtain information about well construction, pesticide use, and land use in the surrounding area from well owners, operators, and county agricultural extension agents. To respond quickly to any sampling questions or problems, EPA set up a telephone hotline for samplers and Survey participants. EPA also conducted audits at a number of field sampling sites to assess the effectiveness of the QC procedures. These audits helped to identify problems or inconsistencies with the SOPs and maintain a high level of quality throughout the sampling phase of the Survey. To enhance further the quality of the Survey, EPA's contractors periodically conducted audits on their own internal operations by their QA personnel and performed routine quality control checks of field operations.

QA/QC In the Laboratory. Each laboratory selected for the NPS had to satisfy certain QA/QC criteria. In addition to having to meet rigorous standards for initial selection as an NPS analytical laboratory, each laboratory also had to maintain the highest analytical chemistry standards throughout the Survey. Day-to-day QA/QC activities included analysis of method blanks (a portion of reagent water analyzed as if it were a water sample), shipping blanks (reagent water transferred to a sampling bottle, shipped to the field, and returned to the laboratory with the samples), spiked samples (samples to which a known amount of analyte is added), and instrument and laboratory control standards. In addition, two EPA laboratories analyzed duplicate samples for approximately ten percent of the total samples collected and provided overflow relief to the primary contract laboratories. All of the laboratories were required to obtain analytical standards from NPS, report results in a standardized format, and pass an automated audit for compliance with QC criteria for all data sets. Audits were conducted periodically to check that all laboratory procedures and instrumentation were accurate and properly maintained, that the laboratories were following the established operating standards, and that data could be tracked and verified from sample collection to the final reporting of results. Performance evaluation studies were conducted to verify the laboratories' on-going analytical capabilities.

QA/QC In Data Management. Data management for the NPS was conducted using the NPS Information System (NPSIS), a computerized management information system. NPSIS was used to develop and monitor sampling schedules, track samples, record data, generate reports, and provide a communications link between the laboratories and the contractor in charge of coordinating the Survey's implementation.

All information obtained from questionnaires was checked for completeness and accuracy. NPS staff made follow-up calls to questionnaire respondents to complete missing information or to confirm responses that appeared to be incorrect. The Survey staff used a standard statistical approach to account for the unavailable, inconsistent, and out-of-range information. All data from the questionnaires were entered into the NPSIS twice and compared, using a computer software program to

control for data entry errors. QA for data entry was implemented through the performance of random audits of the data entry process. After completion of all QA/QC checks, the data were transferred to NPSIS.

Problems Identified and Corrected through QA/QC

The NPS quality assurance program identified and corrected potential problems that could have affected data quality. Quality control checks and quality assurance audits worked together to ensure that sampling, data collection, and laboratory analysis continued on schedule and that field and laboratory staff followed specific procedures. Rigorous reviews and quality assurance audits at each phase of the Survey -- initial planning and design, the pilot study, the full Survey, and data analysis -- assisted management staff in monitoring the progress of the Survey to prevent problems that could compromise data quality. For example, EPA revised the Survey design, based on the pilot study results and SAP recommendations, to correct implementation problems by:

- adopting a two-stage design for identifying community water system wells;
- allocating sampling randomly within the Survey schedule to minimize the possibility of seasonally-induced bias;
- dropping the laboratory method for volatile organic compounds due to problems with sample aeration under Survey conditions; and
- expanding the Survey's questionnaires to collect additional information on well characteristics, cropping, and pesticide use.

The Survey's QA program also provided critical information that prevented serious data losses during sampling and data collection. These situations were rare and were corrected immediately. For example, early in the Survey QA staff identified that the laboratories were receiving an overload of samples. If this problem had not been discovered and resolved, sample data and analysis results would have been lost. EPA quickly provided analytic support to the laboratories and corrected sample storage procedures. EPA also identified trace amounts of chlorine in some well water samples, which adversely affects detecting pesticides. In response, EPA quickly initiated additional procedures to test for chlorine in the field as well as in the primary laboratories.

Quality assurance staff identified other technical problems such as incorrect interpretation of questionnaire terms, an inaccurate instrument calibration standard, and inappropriate delays in computer database backups. Again, as a result of early detection, these minor problems were corrected before serious loss of information or data quality occurred.

Summary

EPA was diligent in supporting and implementing a quality assurance program for the NPS. The Survey's key QA/QC elements -- expert review, pilot studies, training, specific standard operating procedures, detailed quality assurance plans for each major phase of the study, and routine audits -- are now recognized throughout EPA as models for other EPA studies. The direct benefit for the policy analysts, scientists, and others who will use NPS results is an information base of documented, consistent, high quality data on drinking water wells, pesticide use, and ground-water vulnerability.

**Where to Go
for More
Information**

This fact sheet is part of a series of NPS outreach materials, fact sheets and reports. The following additional fact sheets are available through EPA's Public Information Center (401 M Street SW, Washington DC 20460, 202-382-2080):

Project Summary

Summary Results

Survey Design

Analytical Methods

Survey Analytes

Glossary

**Fact Sheet for each
detected analyte**

**How EPA Will Use
The NPS Results**

Additional information on the Survey and on pesticides in general can be obtained from the following sources:

U.S. EPA Safe Drinking Water Hotline
1-800-426-4791 (In Washington, DC -- 382-5533)
Monday-Friday, 8:30 am to 4:30 pm Eastern Time

Information on regulation of
pesticides in drinking
water

National Pesticide Telecommunications Network
1-800-858-7378
24 hours a day

Information on health
effects and safe
handling of pesticides

U.S. EPA Office of Pesticide Programs (OPP) Docket
401 M Street, SW Room NEG004
Washington, DC 20460
(202) 382-3587

Background documents
for Survey (available
for review)

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Copies of the
NPS Phase I Report
(available 1991) and
NPS Phase II Report
(when available)

If you are concerned about the presence of pesticides and nitrate in your private water well, contact your local or State health department. Other experts in your State environmental agency or agriculture and health department may also be helpful to you. If you receive your drinking water from a community water system and have questions about your water quality, contact your local community water system owner/operator or the State water supply agency.